

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

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| Applicant's or agent's file reference ----- | FOR FURTHER ACTION See Form PCT/IPEA/416 | |
| International application No. PCT/NO 2003/000244 | International filing date (day/month/year) 10-07-2003 | Priority date (day/month/year) 27-08-2002 |
| International Patent Classification (IPC) or national classification and IPC G01F 1/28, G01P 5/04 | | |
| Applicant CorrOcean ASA et al. | | |

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:

- a. ☒ (sent to the applicant and to the International Bureau) a total of 2 sheets, as follows:
- ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
- ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

- b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- | | | |
|-------------------------------------|--------------|---|
| <input checked="" type="checkbox"/> | Box No. I | Basis of the report |
| <input type="checkbox"/> | Box No. II | Priority |
| <input type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| <input type="checkbox"/> | Box No. IV | Lack of unity of invention |
| <input checked="" type="checkbox"/> | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/> | Box No. VI | Certain documents cited |
| <input type="checkbox"/> | Box No. VII | Certain defects in the international application |
| <input type="checkbox"/> | Box No. VIII | Certain observations on the international application |

| | |
|---|--|
| Date of submission of the demand 09-03-2004 | Date of completion of this report 17-05-2004 |
| Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88 | Authorized officer Lars Jakobsson /itw Telephone No. +46 8 782 25 00 |

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/NO 2003/000244

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☒ This report is based on a translation from the original language into the following language english, which is the language of a translation furnished for the purposes of:

- ☐ international search (under Rules 12.3 and 23.1(b))
☒ publication of the international application (under Rule 12.4)
☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:

pages 1-6 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished

pages* 9-10 as amended (together with any statement) under Article 19

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☒ the drawings:

pages 1-3 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing (*specify*): _____

☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing (*specify*): _____

☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/NO 2003/000244

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|--------|------------|-----|
| Novelty (N) | Claims | <u>1-7</u> | YES |
| | Claims | | NO |
| Inventive step (IS) | Claims | <u>1-7</u> | YES |
| | Claims | | NO |
| Industrial applicability (IA) | Claims | <u>1-7</u> | YES |
| | Claims | | NO |

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

US 4419898
 US 4186602
 WO 9516186
 US 4788869
 US 5747702
 US 5831176
 US 5211677

None of the documents describe the method and the device for flow measuring as defined in the amended claims 1-7 where pressure, temperature and a momentum sensor is used and where the velocity of a flow is calculated in dependence of the measured values.

The cited documents represent the general state of the art. The invention defined in the amended claims 1-7 is not disclosed by any of these documents.

The cited prior art does not give any indication that would lead a person skilled in the art to the claimed flow measuring method and device. Therefore, the claimed invention is not obvious to a person skilled in the art.

Accordingly, the invention defined in claims 1-7 is novel and is considered to involve an inventive step. The invention is industrially applicable.

Claims

1. Flow measuring method for the measurement of velocity in a single-phase or multi-phase flow, such as a multi-phase flow in a process pipe or similar, characterized in measuring two consecutive values of pressure p, temperature T and momentum D, then to calculate the change in pressure Δp , change in temperature ΔT and change in momentum ΔD , where the method further comprises the steps of calculating the velocity U after the following formula:

$$\Delta D = -\frac{1}{2} U^2 \Delta \rho \quad (5)$$

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where $\Delta \rho$ is expressed as

$$\Delta \rho = -\frac{R_{mix} T}{p^2} \Delta p + \frac{R_{mix}}{p} \Delta T \quad (2)$$

where R_{mix} is the universal gas constant.

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2. Method according to claim 1, characterized in that the method further comprises the step of measuring the pressure p, the temperature T and the momentum D in the proximity of each other in the process pipe.
- 20 3. Method according to claim 1 or 2, characterized in that the method further comprises the step of measuring the pressure p, the temperature T and the momentum D at the same time.
4. A flow measuring device for measuring different parameters in a single-phase or multi-phase flow in a process pipe or process tank or similar, where a probe (1) comprises a housing (2) in a first end (1A) and sensors in a second end (1b), where the housing (2) comprises a flange (21) able to be fastened to a pipe nipple in the process pipe or the process tank, and where the housing (2) preferably comprises electronic components connected to the different sensors in the probe (1) to perform the measurements and then to
- 25 calibrate and transfer the measured results to a central monitoring unit, where the probe (1) further comprises a long, hollow momentum tube (3) fastened by its first end (3A) to the housing (2), where the second end (3B) of the momentum tube (3) is inserted into the process pipe or process tank, and where the probe (1) further comprises a hollow cylindrical sensor tube (4) located inside the momentum tube (3) and fastened by a first end
- 30 (4A) thereof to the first end (3A) of the momentum tube (3), where the sensor tube (4) comprises plate capacitors (CA1, CA2, CA3, CA4) located on the outside of the second
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end (4B), thereby being able to measure the conductance between the momentum tube (3) and the plate capacitors (CA1, CA2, CA3, CA4) on the sensing tube (4), **characterized in** that the probe comprises a pressure sensor, a temperature sensor and a momentum sensor.

- 5 5. Probe according to claim 4, **characterized in** that the pressure sensor and the temperature sensor are encapsulated in, or inserted in, a pressure and temperature unit located in the second end (3B) of the momentum tube (3).
6. Probe according to claim 4, **characterized in** that the probe in its second end further
10 comprises an erosion sensor (5) known per se.
7. Probe according to claim 6, **characterized in** that the erosion sensor comprises a pressure and temperature unit (7).